1934

Forty-Seventh Annual Report of the Agricultural Experiment Station of Nebraska February 1, 1934

W.W. Burr
University of Nebraska at Lincoln

THE UNIVERSITY OF NEBRASKA

FORTY-SEVENTH ANNUAL REPORT
OF THE

Agricultural Experiment Station

OF
NEBRASKA

Presented to the Governor February 1, 1934

LINCOLN, NEBRASKA
U. S. A.

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LETTER OF TRANSMITTAL

THE UNIVERSITY OF NEBRASKA
AGRICULTURAL EXPERIMENT STATION

To His Excellency, Charles W. Bryan, Governor of Nebraska:

SIR: In accordance with the act of Congress approved March 2, 1887, and the act of the General Assembly of the State of Nebraska, approved March 31, 1887, establishing and regulating experiment stations, I have the honor herewith to submit the Forty-seventh Annual Report of the Agricultural Experiment Station of Nebraska.

W. W. BURR,
Director.

February 1, 1934.

GOVERNOR'S CERTIFICATE

STATE OF NEBRASKA, EXECUTIVE DEPARTMENT

Mr. W. W. Burr, Director Nebraska Agricultural Experiment Station:

SIR: I hereby acknowledge receipt of the Forty-seventh Annual Report of the Agricultural Experiment Station of Nebraska.

CHARLES W. BRYAN,
Governor.

Lincoln, February 1, 1934.

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[1] By an act of the Legislature of the State of Nebraska, approved and in effect February 15, 1899, the State Treasurer became *ex officio* custodian of the Experiment Station fund on and after July 1, 1899.

[2] On leave.

[3] Detailed from Office of Western Irrigation Agriculture.

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[4] Detailed from Office of Cereal Crops and Diseases, United States Department of Agriculture, Washington, D. C.
[5] Detailed from Office of Forage Crops and Diseases, United States Department of Agriculture, Washington, D. C.
[6] Detailed from Office of Dry Land Agriculture, United States Department of Agriculture, Washington, D. C.

Forty-seventh Annual Report

This report is for the most part a record of the achievements of the Nebraska Agricultural Experiment Station during the fiscal year ending June 30, 1933. The reports from the substations extend to January 1, 1934. A financial statement showing the receipts and expenditures of the Experiment Station is included.

The projects are grouped and discussed under subject headings. Little or no progress has been made on some projects, while others, on which attention has been concentrated, have been advanced rapidly or completed. Curtailment of appropriations and a reduction in cash funds due to the low prices of agricultural products have necessitated a readjustment of the research program of the Experiment Station. There have been many requests for new information, probably accentuated by the advent of the Agricultural Adjustment program. Efforts have been made to take care of them as far as possible.

In its program of work the Experiment Station is co-operating with several bureaus and offices of the United States Department of Agriculture. A list of the publications issued by the station during the past is given later in the report. The bulletins and circulars issued are available to any citizen of the state by writing the Agricultural Experiment Station, Lincoln, Nebraska.

AGRICULTURAL ENGINEERING

Tractor Testing.—During the year 1932, four manufacturers submitted twelve tractors for tests. Eleven were of the track-layer type. Ten used gasoline and one used kerosene for fuel. The Diesel motor made its first appearance at the Nebraska testing plant and established new fuel-economy records with a low-grade oil used locally as a furnace fuel. A report on the tests made in 1932 was made in Bulletin 277; the report for 1933 will be contained in Bulletin 285.

Wind-driven Electric Plants for Farm Use.—Additional operating data have been collected and a publication is in preparation. Interest in this source of electricity is evidenced by the fact that at least two new manufacturing plants have recently been established for the building of this sort of equipment.

Pump Irrigation.—Pumping tests were continued in a study of the efficiency of different types of wells and equipment. The results thus far obtained have been printed as Bulletin 282, "Pump Irrigation Investigations in Nebraska".

Electric Power on Nebraska Farms.—Subprojects include studies of small electric motors for farms, automatic water systems, the small unit plant, and the electrically operated refrigerator. A general bulletin, entitled "Uses of Electricity on Nebraska Farms—1930-1934," is forthcoming. A feed-processing study is ready for publication. A circular (No. 45) has been printed on installing the mechanical refrigerator.

A Survey of Farm Machinery.—The purpose of this study is to get together some data on the rate of depreciation of farm machinery. A circular based on a study of account books kept by farmers in co-operation with the Department of Rural Economics is in preparation.

Efficiency of Tractor Lugs.—Work has been continued on this project, and a report will be prepared within the next year.

Methods of Cooling Milk on Farms and Their Effect on Quality.—Emphasis is being put on the problem of storage and the use of one compartment for several products. This work is done in co-operation with the Dairy Department.

Adaptation of Pneumatic Tires to Farm Tractors.—During the year a study of the feasibility of pneumatic tires for tractors was undertaken with the co-operation of several tire manufacturing companies. Under certain conditions and in certain circumstances pneumatic tires were found superior to steel wheels and lugs. Under field conditions such as a hay field or sandy soil the tractor equipped with pneumatic tires will usually pull more in intermediate and high than the steel-wheeled tractor. Thus it can often save fuel and time. The steel-wheeled tractor will usually pull more in low gear and can get through slippery spots better than the rubber-tired tractor.

ANIMAL DISEASES

Organisms Belonging to the Hemorrhagic Septicemia Group.—The work under this project has been finished with the exception of the compilation of the detailed reports. A publication will be issued later.

The Influence of Environment on Poultry Morbidity.—Substantial progress has been made. The work on fowl cholera has been finished and that on blackhead of turkeys is almost complete. Publication can be expected soon, in the form of a revision of Bulletin 195 or as a new bulletin. The diseases being studied, in addition to those mentioned above, are bacillary white diarrhea, tuberculosis, coccidiosis, and fowl typhus.

The results thus far on blackhead warrant the conclusion that blackhead is definitely a filth-borne disease and it is possible in poultry yards to reduce the hazard from this disease to a negligible minimum. Contaminated soil, feed, and water are the dominant factors that spread the disease.

Erysipelas among Nebraska Swine.—This disease may cause trouble in the future; its presence has been proved, and it will be difficult to distinguish it, in the field, from cholera. The following data suggest the general status of the disease in this state:

Outbreaks from which material was examined	119
Outbreaks in which swine erysipelas was proved	14
Specimens concurrently examined for cholera	17
Specimens showing hog cholera	12
Specimens containing both cholera and erysipelas	1
Specimens of erysipelas without cholera	5

Laboratory Diagnosis and Examination of Specimens.—This project takes care of the specimens that come to the Experiment Station for examination and diagnosis. During the year 6,282 laboratory examinations were made and reported on.

DAIRY HUSBANDRY

The Principles of Ice Cream Making.—This project includes a study of samples of ice cream from various manufacturers in the state. The past year vanilla and chocolate flavors were scored. Considerable difference was noted in the way samples melted down, and some of the manufacturers have suggested this as a subject for study.

Growth of Dairy Cattle.—Approximately 100 animals are being measured, weighed, and photographed monthly. One phase, on the influence of pregnancy on the gain in weight of lactating cows of four breeds, is being tabulated.

The Vitamin Content of Milk.—Studies of the vitamin A content of skimmilk, standardized milk, and cream from different breeds of cows have resulted in the following conclusions: the vitamin A content of milk is associated largely with the butterfat, and separated milk containing a small quantity of fat contains only a little vitamin A; standardization of the butterfat content of milk by the addition of separated milk reduces its vitamin A potency; and, under the conditions of these experiments, Holstein cream was shown to have more vitamin A than Jersey cream. Approximately 750 rats were used in the three phases of the work. The results will be printed as Research Bulletin 69.

Factors Affecting the Quality of Fluid Milk.—Studies of the bacterial count, sediment, and fat content of milk delivered to the College creamery by farmers has been continued. Reports to producers on quality and the system of bonuses and reductions have continued to promote improvement. The operation of a milk pool by the local co-operative milk association has caused the discontinuation of some of the work.

In the herd owned by the Experiment Station, cows known to produce milk with high counts have been eliminated. Other factors causing high counts have been the rubber teat cups on milking machines, the life of which is about three weeks with four-time milking and about 50 cows to the milking; carelessness in washing and sterilizing the milking machine and the utensils; failure to clean the cow; and the udder flora. A study of milk quality as affected by the individual cow has shown the presence of streptococci in fresh milk to be a cause of low quality. In monthly studies of udders high bacterial counts of milk were usually found accompanied by streptococcus, and a salty taste was found commonly in cases that showed high leucocyte content and in cases of mastitis. Study of the udders and other aspects of the infection problem will continue.

Manufacture of Cream Cheese.—Attention has been given to improving the keeping quality of cheese. By developing the proper acidity, heating after the cheese is curdled, and avoiding contamination, cheese that will keep under refrigeration for from two to three weeks can be produced. It has been found that this cheese can be made on a small scale and marketed profitably.

The Effect of Metals on Milk.—The work on this project is just getting under way. The equipment has been obtained and a few experimental runs have been made.

FIELD CROPS AND SOILS

Corn Improvement through Inbreeding and Hybridization.—This project is directed toward the development of superior corn hybrids between selfed lines, which will be practical for farm use. One hundred sixteen hybrids, largely three-line and four-line first-generation double crosses, and 20 varieties were tested for yield in 1932. Twenty-nine of the hybrids were obtained from other states. Two double crosses developed from Nebraska White Prize averaged 14 and 13 bushels per acre higher than the standard variety of Hogue Yellow Dent, which yielded 47.3 bushels. Iowa double cross No. 13, an experimental hybrid from the Iowa Experiment

Station, was highest of the yellow corn, 12.6 bushels above Hogue. A double cross designated as Nebraska No. 238, involving Illinois and Iowa inbreds, was 9.5 bushels above Hogue and 9.7 bushels above the average of 22 farmers' varieties. The White Prize hybrids usually mature too late here, but these yellow hybrids are well adapted. Krug, the highest-yielding commercial variety, ranked twenty-third among the lots in the experiment. Five commercial hybrids from Iowa and Illinois averaged 48.1 bushels, only two per cent better than Hogue.

In 1933 the first attempts were made to have farmers produce hybrid seed by means of natural crossing plats. Seed stocks of the two single-cross parents used to produce seed of the Nebraska double cross No. 238 above described were distributed to 32 Nebraska farmers who planted them in natural crossing plats. This will provide a seed supply for a considerable acreage in 1934.

Corn Tillage Practices.—The results of eleven years of cultivation tests will soon be ready for publication. It may be concluded that weed control is the main consideration in cultivation of corn. Some stirring of the soil, however, is beneficial as evidenced by the yield of 29.7 bushels per acre obtained from merely scraping the ground to control weed growth in comparison with 34.0 bushels per acre secured from normal cultivation. No serious injury from root pruning is likely to occur under normal conditions of cultivation. Root-pruning studies, in which roots were cut at varying depths and distances around the corn plants, disclosed the fact that only deep, close pruning such as would not ordinarily occur in the field had any serious effect on the yield. In these controlled tests very severe pruning lowered the yield 11.3 bushels per acre below the unpruned. Listing, surface drilling, and surface checking have been compared for 11 years as methods of planting; the data indicate that only small differences in yield may be expected under conditions such as prevailed at Lincoln during the period under study.

Small Grains—Studies of Varieties, Breeding, Acclimatization, and Culture.—The varietal testing and breeding investigations with winter wheat are co-operative with the U. S. Department of Agriculture. The Nebraska selection from Crimean winter wheat which is known as Cheyenne has continued to show its superiority over ordinary Turkey. It resists lodging and shattering and tolerates the Hessian fly, although it is not resistant to it. It is popular with farmers.

Nebraska No. 60, a selection from Turkey, now comprises about 65 per cent of the wheat acreage in the state. In 20 years it has averaged six per cent better in yield than its parent variety, whereas Cheyenne in the last five years has averaged 14 per cent better. A new Turkey selection that is resistant to local stinking smut and Hessian fly and is attractive in other respects is being increased for more extensive tests. A number of hybrid selections are also showing promise.

A three-year comparison at Lincoln has shown no significant differences in the winter wheat yield from the use of three types of furrow drill. The average yield from furrow drills was, however, 7.8 bushels per acre less than from standard 7-inch surface drills. The lower yield was found largely due to inability of the wheat planted in such widely spaced rows (14 inches) to fully occupy the land.

During nine years, four of which have been bad Hessian-fly seasons, October 1 has proved superior to both September 23rd and October 8th as planting dates. This superiority has amounted to 4½ and 5 bushels in acre yield, respectively. Plowing in July, supplemented by disking to control weeds and volunteer grain, has continued to show great advantages as a method of preparing the seed bed for winter wheat.

A severe epidemic of stem rust of oats in 1932 showed the superiority in rust resistance of Iogold and three new selections of Burt oats known as Nebraska No. 518, Nebraska No. 520, and Nebraska No. 529. This superiority amounted to about 15 bushels per acre. Nebraska No. 520 has been one of the highest yielding varieties in the field tests. A large number of segregates from a cross between Markton and Iogold have been selected because of their outstanding resistance to smut and stem rust.

The smooth-bearded varieties of barley have continued to show their superiority over Common Six-row. In the past five years Komar has exceeded Marquis spring wheat by 26 per cent, and Ceres, now being grown in the state as a certified crop, has exceeded the same wheat by 15 per cent. Komar has also proved most productive at the Box Butte Experimental Farm.

Forage Crops, Grain Sorghums, and Soy Beans.—A study to determine the yields of various legumes when grown on soil depleted of subsoil moisture by a previous cropping to alfalfa gave these results: the average annual yield during three years of alfalfa, sweet clover, and red clover on soil previously cropped for six years to alfalfa were respectively

2.67, 2.65, and 2.97 tons; on land not previously cropped to alfalfa corresponding yields were respectively 3.87, 2.75, and 3.39 tons per acre. It is apparent that alfalfa is the superior crop if the subsoil moisture has not been depleted, but if the opposite is true its yield may be equalled or surpassed by sweet or red clover. The choice of these crops may then be based on other factors than yield.

The experiments on variety testing and breeding of alfalfa are in collaboration with the U. S. Department of Agriculture. Considerable interest has developed in Hardistan and Turkestan alfalfa because of their superior resistance to the bacterial wilt disease and low temperatures, although their yield has been somewhat below that of Grimm and northern-grown Common alfalfa under conditions where this disease is not a serious factor. Because of its special virtues of wilt and cold resistance and consequent longer maintenance of stand, the Hardistan is being distributed for farm use. It is estimated that 275 acres are now being grown for seed production on 35 farms in seed-producing areas of the state. Among the newest varieties of promise, Ladak has been outstanding. Seed from France, Italy, South Africa, Argentina, California, and Arizona has proved unadapted to Nebraska conditions.

The alfalfa improvement program is being continued. Selection for seed production within self-fertilized lines is reported upon in a paper being prepared for publication. The results indicate that the seed yield per plant has been greatly increased by this method of selection. Many of the self-fertilized lines which are under test in the nursery continue to show high yielding ability as well as a high degree of resistance to the wilt disease and low temperature.

Owing to decidedly favorable moisture conditions various annual forage crops gave exceptionally high yields of cured forage in 1932 as follows: Common millet 5.3 tons, Sudan 4.5 tons, Kansas Orange cane 6.2 tons, Black Amber cane 7.2 tons.

During the past seven years, a number of grain sorghums have equaled or somewhat exceeded standard corn varieties in yield of both grain and fodder. Two or three recently developed early maturing grain sorghums may prove particularly well suited to southern Nebraska. As a 7-year average, Atlas Sorgo has been the most productive silage crop tested. In addition to yield, factors such as ease of securing stands, weed control, and the harvesting, storage and marketing of the grain must be given consideration when sorghums are compared with corn.

The following yields in bushels per acre were obtained in 1932 from varieties of soy beans grown in cultivated rows: Manchu 29.2, Virginia 24.8, Illini 34.7, Ito San 31.9, Aksarben 30.4, and Midwest 22.1. When planted in uncultivated seven-inch rows the yield of Manchu beans was 21.7.

Management of Permanent Pastures and Native Meadows.—Co-operative experiments for the improvement of permanent pastures were established with three eastern Nebraska farmers during 1932. The effects of fertilizers, cultural practices, and seeding of desirable pasture plants were studied. The application of manure and ammonium sulfate increased yields appreciably, while lime and superphosphate showed no gains. The disking of pastures was decidedly detrimental. The sowing of additional forage seeds into permanent pastures as an improvement measure is an uncertain practice. Two more extensive co-operative projects were established during 1933 to investigate further the effects of fertilizers and cultural practices and in addition to note the effects of burning and different intensities of clipping, simulating pasture conditions. The eradication of the more serious pasture weeds by different times of mowing and the use of chemicals is being studied.

An experiment to determine the effects of introducing cultivated forage plants into the subirrigated prairie meadows of the Elkhorn Valley and the sandhills has given favorable results and is being continued.

Soil Tilth.—The properties of soil friction and plasticity were under investigation during the year. Previous study had shown that the coefficient of friction was independent of area of contact of any given character of soil surface. It appears, however, that variations in the granular character of the surface have a large effect. With powdered granules that pass a 0.5 mm. sieve used as a basis, the coefficient of friction is decreased over 20 per cent as granule size is increased up to 2 mm. For the study of plasticity an apparatus has been developed in which soil of definite moistness falls and extrudes through an opening in the bottom of its container. The theoretical formula for the amount of soil extruded (E) is:

$$E = K\, m \sqrt{h}$$

where m is the mass of soil, h the distance of fall, and K an instrument constant involving the diameter of the orifice. The results thus far support the principle involved. A somewhat similar apparatus is being developed for observing the end point of the upper plastic limit.

The Restoration of Organic Matter in Nebraska Soils.—The experiments for determining the rate and the nature of decomposition of various organic materials when added to small plats of soil under field conditions are being continued. A set of plats has also been established to determine the effects on organic matter and nitrogen of various modifications of a rotation of corn, oats, and wheat. These modifications are sweet clover as a catch crop in the wheat, the application of lime and superphosphate, the application of manure, the application of nitrogenous fertilizer on the wheat in the spring, and the untreated rotation. At the Box Butte Substation a wheat field is being used to study the effects on organic matter of plowing, disking, growth of sweet clover, application of nitrogenous fertilizer, burning the straw and stubble, and summer tillage. This was begun in 1930 and the plan calls for testing at four-year intervals.

The Availability of Phosphorus in Soils of Alkaline Reaction as Related to the Usage of Phosphate Fertilizer.—In the laboratory a percolator has been perfected for obtaining soil extracts for analysis, with which continuous water extractions from a number of soils have been made. The amount of phosphorus extracted has been found to follow the formula:

$$\text{Log } A - \log (A-y) - \log C = kv$$

where A is the maximum amount of phosphorus removable by the extractive used, y is the amount actually removed by a volume of extractive v, and C and k are constants of integration and proportionality. A is apparently independent of the rate of extraction. C and k vary with different soils. So far it has not been found that either y or A values correlate satisfactorily with field response to phosphate.

FRUITS AND VEGETABLES

Pruning Apple Trees.—One object of this experiment is to compare heavy with light pruning at transplanting time. Jonathan and Winesap trees are included, and the transplanting was done six years ago. Half of the trees were removed and studied in 1931 and half of the remaining trees in 1932. Results secured from trunk measurements of the filler varieties at Union indicate that the system of training used in the early years of the life of the apple tree has little effect upon its diameter in later years.

Variety Testing.—The 1932 strawberry tests indicate that Dunlap outyielded Blakemore by at least one-third, in spite of the heavier frost damage to the Dunlap variety. The strawberry field was renewed and continued. Gooseberry

varieties were compared as to size of fruit. This was obtained by counting the number of berries per quart. Houghton and Abundance had the lowest counts, Downing and Oregon Champion the highest, and Josselyn, Pixwell, and Carrie intermediate counts.

Orchard Culture.—The 1932 apple yields from the cultural blocks were so light that no definite suggestions as to their significance can be made. The clean-culture block was seeded to sweet clover with moderate success. Korean Lespedeza will be tried next spring. Blight was not worse than in 1931, although it did spread somewhat to other varieties, notably York. There seemed to be a correlation between culture and this sort of infection.

The soil-treatment work with grapes includes cultivation, the use of fertilizers, scraping the ground, and mulching. No cultural treatment has thus far been superior to ordinary cultivation.

Fruit Stocks Investigation.—Data on average trunk diameter, average height, and dimensions of top have been obtained for the trees remaining in the top-worked orchard. Half of the original trees were taken out in 1931. The trees on Virginia Crab stock have again shown the most vigorous growth. Similar data will be obtained on the scion-rooted orchard at Union.

Orchard Spraying.—In 1932 special attention was given to testing materials for the control of apple scab and black rot on Jonathan trees in an orchard at Shubert. Scab infection was severe and rainy weather prevented an effective application of the calyx spray. The pink spray, often omitted in Nebraska, was badly needed in 1932. Two strengths of liquid lime-sulfur, 1-50 and ¾-50, were used throughout the season. In another plat liquid lime-sulfur was used in all fungus sprays, but the pink spray was omitted. Two strengths of Bordeaux were used in two other plats, following liquid lime-sulfur in the pink and calyx sprays. Dry lime-sulfur, Kopper's Flotation sulfur, and Koloform were also tested. In checking the results on the foliage difficulty was encountered and more work on that phase will be done next year. Data from the fruit show that there was a heavy infection of scab on unsprayed fruit and that liquid lime-sulfur and Bordeaux, the old well-known fungcides, gave the best control of the disease. The 2-4-50 Bordeaux seems to be as weak a dilution as it is safe to use. The same is true of 1-50 lime-sulfur. Black rot was probably as severe as in previous sea-

sons but the general use of Bordeaux in the summer sprays kept it under control.

Root Systems of Apple Trees.—Trees are excavated from the culture plats in order to study root growth. In the deep loess soil at the Union orchard trees are more deeply rooted than at Lincoln. At Union the growth of corn near the trees checked lateral root development, especially when the corn row was only 3½ feet away.

Experiments with Asparagus, Lettuce, Spinach, and Tomatoes.—The five-year average yield of the largest crowns of asparagus has been 41 per cent higher than that of the smallest size. Variation of the cutting period from 4 to 10 weeks has shown that the longer periods have not caused a reduction in yield. Mulching with straw or manure has proved undesirable. The mulches reduce yield and hinder the emergence of spears. Adding salt to the soil resulted in reduced yields. Shallow planting has proved superior to deep planting.

Straw-mulching head-lettuce plants just after they are transplanted from the greenhouse has resulted in more compact but smaller heads than with cultivation. Testing of varieties of spinach for resistance to flower production is in progress, with no results thus far. Applications of superphosphate to loess soils south of Nebraska City have increased the yields of tomatoes 25 per cent. Manure has caused similar gains, but both together have resulted in only slightly greater gains. Good northern-grown tomato plants have proved 25 to 40 per cent superior to commercial southern-grown plants.

Storage of Seed Potatoes.—This work has been carried on for two seasons at the Box Butte experimental farm and involves such phases as cellar storage, cold storage, maturity, a warming period after cold storage, exposure of cut seed to the sun, and others. The addition of a fall period of cold storage to the spring period increased the number of rotten tubers and slightly increased the weight of sprouts but reduced the number of stems per seed piece. Cold storage from November 15 on was better than immediately after harvest or later in the storage season. Putting potatoes into cold storage in the spring resulted in a lower stand, especially when put into storage as late as June 1, and tended to increase the number of stems per plant. Other cold-storage treatments resulted in increased yields over cellar storage of 10 to 25 per cent. Taking potatoes out of cold storage late rather than early proved beneficial as regards soundness of tubers and stands. The number of stems per seed piece decreased with each pro-

longation of the cold storage, and the yields were generally proportional to the stands. Transferring potatoes from cold storage to the cellar two weeks before planting, in comparison with two days, resulted in greater stimulation of growth, slightly more rot, and a slightly better stand.

Tubers immature when harvested lost more weight than mature tubers. Scabby potatoes of medium maturity lost more weight than less mature and less scabby potatoes. Tests with seed potatoes cut in various ways and placed in cold storage shortly after harvest in 1932 indicate that while early weight loss is avoided the practice is not so good as storage in a cellar for several days before the cold storage. Pieces cut lengthwise lost less weight than those cut crosswise or diagonally. Tubers with straight cuts or cracks lost still less. When cut surfaces were exposed to the sun for 1, 2, 4, and 8 hours before storing, the weight loss increased with each lengthening of the exposure asd the differences became greater as the storage season advanced.

Nutritional Conditions Influencing the Potato.—The object of this experiment is to determine the nutritional conditions underlying the nutrition and development of stolons and tubers under various conditions. The results briefly are as follows: High nitrogen favors growth, but delays tuber development. Reducing the N increases the supply of carbohydrate and retards vegetative growth and stimulates tuber growth. After tuberization has begun, vegetative growth is retarded or completely stopped. With prolonged N starvation the plants become chlorotic and tuber growth slows down, but if, after a period, N is again supplied, tuber growth is stimulated more than growth of leaves. New stolons may be forced out at the nodes where older stolons were produced. The median stolons on the portion of the stems underground usually produce tubers first. Tuber shape seems to be unaffected by nutrition. During long days with high temperature, tuber development was not so great in proportion to other growth as during winter days with low temperature.

Cultural Experiments with Potatoes.—As a result of eight years' tests of time of planting in Box Butte county on dry land, June 20-25 has proved to be best. Research Bulletin 61 contains the results up to 1930.

Development of Tuber-line Strains of Seed Potatoes.—Tuber-line strains have been isolated from several commercial lots of Triumph potatoes. These differ with regard to length of growing season and size of plant. They have been increased

from seed indexed in the greenhouse for virus disease. About 20 to 25 per cent of the 1932 certified seed acreage in Nebraska was planted with these tuber lines. About 95 per cent of the certified acreage is planted with indexed stock. The tuber lines provide greater uniformity in all respects. The early strains seem most desirable at Lincoln and under irrigation at North Platte and Scottsbluff, but on dry land at Alliance the medium and late strains seem better except for late planting, for which the early strains have proved best. Similar work is being started with the Irish Cobbler variety.

HOME ECONOMICS

Electric Cooking Stoves.—The testing of five stoves representing various types of surface units and ovens has been completed and the results were published in Research Bulletin 68 in October, 1933. Variations in the efficiency and time of heating were found for the surface units, and merits and defects in the types of ovens were brought to light. The adaptation of various types of utensils to electric stoves was also studied and the results are reported in the same bulletin. A popular circular will also be issued, dealing with the selection and management of electric stoves,

The Family History and Standards of Living of Farm Families in Selected Districts in Nebraska.—This project will probably be completed in 1934. It has been extended to include a study of technique in gathering data on diet and its adequacy. A four weeks' intensive food study of a number of selected families is being made, the weeks being one from each season of the year. The plan is to compare the record of these four weeks with the year's record, which is kept under more normal conditions but with less detail and accuracy. Estimates of food consumption will be obtained also by the schedule method from the same families, if possible, so that the three methods can be compared.

Variability in the Cooking Quality of Navy Beans.—This work has been started. A comparison is being made of beans from various regions in the United States. Work thus far indicates that Nebraska-grown beans are equal to other beans in cooking quality and palatability.

Relief Agencies Available to Farm Families.—This study is to be of short duration. Records of relief agencies were found unavailable for the two or three years before 1932. Information is available, however, for the years 1932 and 1933.

INSECT CONTROL

The Hessian Fly and Other Injurious Insects.—Work on the Hessian fly was resumed in 1929 and has been continued since. Field observation stations were maintained in Fillmore and Phelps counties from August to early October for the study of the relation of rainfall and temperature to the emergence and egg-laying of the main fall brood. In addition studies of the life history and control of other insects, of minor importance, were carried on in the new insectary. These include cherry slug, imported cabbage worm, egg-plant flea-beetle, boxelder plant bug, and house ants.

Life Histories of Several Common Cutworms.—The portion of the project that includes keys to the various kinds of cutworms that are known to attack crops is now completed and is being prepared for publication as a research bulletin. The part dealing with life histories and control measures will require more time.

Grasshopper Control.—A careful study of the value of kinds of baits was continued. Definite evidence that certain ingredients and methods of preparation improved the bait was obtained.

A Brood Study of the Codling Moth in Southeastern Nebraska.—The weather conditions of 1932 gave opportunity for further study of the codling moth. The aim is to find the relation of weather to variations in development and to codling-moth populations in the orchard.

LIVESTOCK FEEDING

Wintering Rations for Stock Calves.—The fourth trial in a series on wintering was closed in April, 1933. Several new comparisons were made. In a comparison of Atlas Sorgo ensilage with corn ensilage, the former produced 85 per cent of the gain per ton that the latter produced, but it yielded 29 per cent more and hence produced 10 per cent more gain per acre. The sorgo yielded 13½ tons of ensilage per acre. In a comparison of Atlas Sorgo ensilage with chopped corn fodder, the latter produced 40 per cent less gain per acre than the former.

Steer calves were compared with heifer calves on a ration of corn silage and alfalfa. The heifers were slightly more efficient in feed utilization and carried considerably more flesh at the close than the steers did. Yearling steers were compared with steer calves on corn silage and alfalfa. The yearlings gained 35½ per cent more than the calves and their

feed efficiency was 83 per cent of that of the calves. All of the cattle in the wintering experiment will be finished during the summer and fall.

Cattle from previous wintering tests were fed out in the summer of 1932. Four lots of steers were fed from April 19 to July 16 on corn, alfalfa, and a pound of cottonseed cake daily. Foot rot caused lower gains than usual. Three lots of steers were fed 190 days on shelled corn while on pasture. Late in the summer they were put in a dry lot and fed corn and alfalfa. Winter rations proved to have no effect on summer gains. A gain of about 2¼ pounds per day was made in all lots.

Temporary Pastures.—This project was begun in 1932. The departments of Animal Husbandry and Agronomy cooperate in this work. Twelve fenced pastures of 1½ acres each were planted with temporary crops including rye, sudan grass, first and second year sweet clover, and oats and sweet clover together. By establishing a suitable sequence of two or more the carrying capacity was increased nearly threefold.

The most grazing was obtained where rye was used from April 18 to June 3. The ground was then plowed and on June 4 planted to sudan grass. This was grazed from July 12 to September 21. One acre provided 312 steer days, or the equivalent of 10 months of grazing for one steer. Each of the two crops provided the same amount.

White sweet clover seeded with oats ranked second, providing 232 steer days. The ground was seeded April 16 and grazed from June 13 to October 11. Second-year sweet clover grazed from May 11 to July 25 supplied 220 steer days. Sudan grass used from June 20 to September 21 produced 177 steer days. Native sod pasture (mostly blue grass) produced 145 steer days.

The Effect of Corn in Various Forms on Rate and Economy of Gain.—Four lots, each containing 10 head of 639-pound yearling steers, were fed 180 days.

Ration	*Gain in pounds*	*Sales price*
Lot 1, Shelled corn	429	$5.50
Lot 2, Cracked shelled corn	433	5.75
Lot 3, Ground ear corn	430	5.50
Lot 4, Ground snapped corn for 80 days, ground ear corn 60 days, and ground shelled corn 40 days	403	5.25

Lot 2 gained most rapidly during the early part of the experiment but they were overtaken by Lots 1 and 3 after the 120th day. Lot 1 required the least grain, 692 pounds, to

produce 100 pounds of gain. Lot 2 had slightly more finish and sold higher, but there was insufficient difference to justify the grinding.

Rations for Fattening Pigs on Sudan Grass.—Eight lots of spring pigs were fed for 100 days upon various grains and supplements while on sudan grass pasture. Adding tankage to shelled corn increased the daily gain from 0.98 to 1.41 pounds; 35 pounds of tankage saved 110 pounds of corn in producing 100 pounds of gain. The pigs receiving no tankage rooted up the sudan grass badly.

Rolled wheat produced slightly higher gains than whole or cracked wheat. Tankage was fed in this comparison. In producing 100 pounds of gain, 43 pounds of wheat and 5 pounds of tankage were saved by rolling, while 31 pounds of wheat and 4 pounds of tankage were saved by cracking. Satisfactory gains were made by all three lots.

Several protein mixtures were compared with tankage as supplements to corn. Soy beans and tankage mixed 4 to 1 gave a slightly lower gain, a decrease in daily corn consumption of 1.04 pounds, and an increase in supplement consumption of 0.04 pound. To produce 100 pounds of gain, 56 pounds less corn and 31 pounds more supplement were required. The soy-bean-fed pigs produced soft carcasses. Their back fat was 1.26 inches thick in contrast to 1.58 inches on the straight tankage lot.

Soy-bean oil meal and tankage mixed 4 to 1 produced 0.09 pound greater daily gain than tankage alone; 1.24 pounds of the mixed supplement were consumed daily in contrast to 0.49 pound of tankage. Four hundred six pounds of feed in the mixed-supplement lot were required to produce 100 pounds gain in comparison with 400 pounds in the tankage lot. The carcasses of both lots graded hard. Obviously, extracting the oil from the soy beans eliminated the soft pork factor. A vegetable protein mixture of equal parts of cottonseed meal, linseed oil meal, corn gluten meal, and soy-bean oil meal produced 0.10 pound less daily gain than tankage.

The Effect of Method of Preparation on the Feeding Value of Barley for Pigs.—In a test designed to ascertain the most satisfactory way to feed barley, 10 lots of 103-pound pigs were fed 69 days. Tankage was used in all cases. One lot of corn served as a check. This lot gained 1.61 pounds per head daily and produced 100 pounds of gain upon 346 pounds of corn and 45 pounds of tankage.

In a self-fed series, finely ground barley produced 1.88 pounds of daily gain; cracked barley, 1.63 pounds; and whole barley, 1.42 pounds. To produce 100 pounds of gain on finely ground barley, only 80 per cent as much feed was required as on the whole grain. Cracked barley required 88 per cent as much as the whole grain.

In a series where the rations were hand-fed dry, whole barley produced 1.15 pounds daily gain; cracked, 1.59 pounds, and finely ground 1.65 pounds. To produce 100 pounds of gain on finely ground barley required 85 per cent as much feed as on the whole grain. Cracked barley was slightly more efficient and required but 83 per cent as much.

In another series, the feed was soaked and hand-fed. Whole barley produced 1.21 pounds daily gain; cracked barley, 1.51 pounds; and finely ground, 1.64 pounds. To produce 100 pounds of gain on finely ground barley required 96 per cent as much feed as on whole grain, while on cracked grain it required 98 per cent as much.

Forage Crops for Hogs.—Seventy head of 12-weeks-old pigs averaging 52 pounds were used in a growth and fattening experiment which was started July 16. Ten head were kept on a full feed of corn and tankage and were used as a check. The rest were used in a growing test and were later redivided and used in an 85-day cornfield feeding test. The lot on full feed proved to be far more efficient in feed utilization than the lots on growing rations. In the cornfield the results amply justified the use of supplements. Tankage in the self-feeder proved most efficient. This lot was the only one to finish in the 85-day period. All other lots were self-fed for 22 days on shelled corn and tankage following withdrawal from the field, and all ate an unusually large amount of tankage.

Linseed Meal, Cottonseed Meal, and Corn Gluten Meal as Supplements to Corn and Alfalfa in Fattening Lambs.—Eight lots each containing 25 head of 60-pound lambs were fed 100 days in a third trial in this series. Cottonseed meal produced the largest and most efficient gain. In producing 100 pounds of gain 43 pounds of cottonseed meal replaced 80 pounds of corn and 105 pounds of alfalfa. In the average of three trials corn gluten meal has proved most efficient and linseed meal least efficient. No advantage has been obtained from mixing the supplements.

Five lots of 25 lambs each were fed 87 days to determine the advisability of adding protein supplement to corn and alfalfa when the total digestible nutrients and digestible crude

protein are equal. Linseed meal, cottonseed meal, and corn gluten meal were used, and corn starch was added to the protein supplements in order to keep the total digestible nutrients and the digestible crude protein equal. No extra gain was produced by the supplements. Apparently corn and alfalfa furnish a practical amount of nutrients for fattening lambs.

Twelve lambs were fed 148 days in an individual feeding test to study the effect of the same supplements upon the fattening lamb and upon the carcasses when the supplements constitute 50 per cent of the concentrate ration. Results showed no appreciable difference in the three supplements fed under these conditions. Gains in the replications were not consistent. No ill effects observed were attributable to the rations. The carcass studies were largely of a negative order. The refractive indices showed the fat on the controls (fed corn without supplement) to be the firmest. Palatability sudies gave a narrow range of grading, indicating uniformity in quality.

Production of Market Lambs from Aged Western Ewes.—The third trial under this project was completed. Three lots of bred western ewes were fed on three planes of nutrition to permit a study of effect on weight of ewes, birth weights of lambs, market value, and other factors. Ewes fed a medium grain ration during pregnancy made the largest gains, produced the heaviest lambs, and showed the best financial returns in this series, where a no-grain ration, a medium grain ration, and a heavy grain ration were compared. The lambs from this group also made the best gains.

MILLING AND BAKING

Preparation and Study of the Cereal Glutelins.—Work has substantiated further the view that "glutenin", as prepared from wheat flour by any known methods of isolation and purification, can not be regarded as a definite chemical entity. Beyond reasonable doubt the same may be said of the so-called "glutelins" of the other cereals. Furthermore, this same situation doubtless prevails with regard to "gliadin", which has been customarily considered to be the other chief protein constituent of wheat gluten. It is becoming increasingly apparent that the gluten of wheat flour is made up largely of a heterogeneous mixture of "dissociable components".

Any so-called "purified protein preparation" from wheat flour or gluten probably consists of a group of these "dissociable components" having similar properties. Preparations

having constant properties are obtained so long as *the same method of preparation* is adhered to in all details. Variations in method of preparation cause variations among the component groups and therefore measurable variations in the chemical composition (as well as in physical properties) of the preparations themselves.

These beliefs are somewhat in conformity with the findings of Sorenson (Compt. rend. Lab., Carlsberg, Vol. 18, No. 5, 1930), who has concluded that perhaps all of the soluble proteins are "reversibly dissociable component systems". In the case of the gluten proteins, however, there is as yet some doubt as to the *reversibility* of all of the various component groups that may be isolated from them. It is true that various different protein "fractions" (component groups?) can be isolated by minor variations in technique. These "fractions" vary *systematically* with respect to reversibility, susceptibility to denaturation, solubility, and chemical composition.

For the purpose of briefly indicating the nature of these systematic variations one may conveniently consider the various component systems of gluten as falling roughly into three groups. There is the "glutenin" group, the "gliadin" group, and a third group having intermediate properties and designated as "mesonin". The component systems of the glutenin group are the most insoluble and the least readily reversible. The gliadin "fractions" are the most readily reversible and the most soluble. The "mesonin" group is intermediate with respect to these properties, as would be expected. The irreversibility of the glutenin group is probably due to the fact that the components of this group are highly susceptible to denaturation during their exposure to the reagents (alcohol, salts, etc.) used in their preparation. If denaturation could be completely avoided, it might be found that these glutenin systems are also reversible. Systematic variations in chemical composition have been proved by analyses of the products of hydrolysis of a considerable number of glutenin, gliadin, and mesonin preparations, respectively.

Enzymes of Wheat Flour as Related to Flour Grade and Baking Characteristics.—Because of the urgent need in the wheat industry at the present time for a satisfactory standard procedure for the estimation of diastatic activity in wheat flour, and because of the failure of existing methods to give satisfactory results in the hands of different technicians, effort during the year has been devoted to the development of a suitable laboratory procedure for the determination of

flour diastatic value. The result has been a method that appears well suited for this purpose.

The method for which specifications and details are being published in the May, 1933, issue of *Cereal Chemistry* is based upon Hagedorn and Jensen's (Biochem. Zeitschr. 135:45-58, 1923) micro-method for the estimation of blood sugar. This method depends upon the reduction of potassium ferricyanide to ferrocyanide by reducing sugars in alkaline solution, followed by iodometric titration of the unreduced ferricyanide. Its adaptation for use with flour and cereal products necessitated a study of numerous factors involved, both individually and in relation to each other. The proposed method, when used strictly according to specifications, appears to combine the following features: (1) reliability, (2) simplicity, (3) convenience, (4) minimum requirement for special equipment, and (5) consistent agreement among different laboratories. It is being submitted to the Association of Official Agricultural Chemists as a suitable basis for an "official" method.

PLANT DISEASES

Environmental Conditions Influencing the Development of Stem Rust in the Absence of an Alternate Host.—This study, covering ten years, has been completed, with the general conclusion that an epidemic is possible under a sequence of the following conditions: (1) a large amount of initial inoculum reaching Nebraska when conditions favor maximum infection and the subsequent production of large numbers of primary uredia over a wide area; (2) winter wheat entering the heading stage the first week of June or thereafter, with primary uredia appearing about the same time; (3) an extended fruiting period during which optimum temperature, an evenly distributed precipitation above the normal, and other favorable conditions are at hand for rapid development of urediosporic conditions.

The Pathological and Physiological Aspects of Alfalfa Failures in Nebraska.—About 200 additional varieties, strains, and selections were tested and rated for cold resistance during the past season. This work is co-operative with the U. S. Department of Agriculture. Research Bulletin 66 contains the results of three years' testing of alfalfas from the United States, South America, Europe, Africa, and Asia. Except for seed originating from a few old fields of Turkestan and Ladak and the seed lots of Turkestan origin, all were found susceptible to wilt. It has been found that wilt-resistant

alfalfas should be isolated from susceptible sorts when they are grown for seed; otherwise cross pollination will weaken their resistance.

It appears that the trend of cold resistance for each successive uneliminated inbred generation is sharply lowered, but that when cold elimination is practiced the remaining plants, when selfed, yield progeny with much greater cold resistance. Much of the same relationship occurs in selfed lines and in the progeny of individual plants selected for wilt resistance. With few exceptions it has been possible by elimination through wilt and cold testing to obtain individuals, the progeny of which show a high resistance to both wilt and cold.

Research Bulletin 63 contains the results of a study of the nature of resistance in alfalfa to wilt. It was found that resistance in some alfalfas is associated with certain morphological features, particularly in the root, which inhibit rapid development and invasion of the vital tissues by the bacteria. Differences in these features may be modified by environment; for this reason not a single alfalfa has been found completely resistant.

Hardiness of Alfalfa, Winter Wheat, and Other Crops.—During the past few years a study has been made of environmental influences on hardening, in co-operation with the U. S. Department of Agriculture. A method has been developed by which hardiness in alfalfas can be determined by their enzymatic response. For several years hardiness studies of winter wheats have been in progress, and work with spring grains has been under way for the past two years. The Department of Agronomy and the U. S. Department of Agriculture co-operate.

Potato Scab and Fusarium Wilt in Relation to Infection from the Soil.—The data from a scab survey conducted on 100 western-Nebraska farms several years ago have been prepared for publication. Analysis of the data shows that length of time between potato crops was the most important factor in relation to scab infection. The interval between crops had no influence on Fusarium wilt. There was a definite correlation between decreasing amounts of scab and increasing H-ion concentration from pH 6.0 to 8.5. Scab, Fusarium wilt, and Rhizoctonia are being studied in connection with rotation experiments at the Scottsbluff and Box Butte substations.

In the greenhouse the effect of soil temperature, moisture, and aeration previous to the time of tuber formation is being studied in both sterilized and unsterilized inoculated soils.

Preliminary tests indicate that the factors that influence scab development during the time of tuber formation may also influence the potential scab-producing power of the soil. *Actinomyces scabies* has been found capable of attacking and rotting the stems and stolons if the soil is heavily inoculated. A large number of strains of this organism reported from Europe as pathogenic have been tested.

Extensive studies of soils, in both the field and greenhouse, have been made by the dilution-plate method in an attempt to correlate either the number or the percentage of Actinomyces and other organisms with the amount of scab produced on such soils. The results to date are not very encouraging. Histological studies have been made of infection phenomena with different varieties of tubers at various ages. Physiological and morphological studies of strains of *A. scabies* and other pathogenic species are being conducted.

The Cherry Leaf Spot Disease Caused by Coccomyces Hiemalis.—This project, in co-operation with the Department of Horticulture, has been confined to a study of the time and number of spray applications necessary for control of leaf spot on Early Richmond and Montmorency cherries. In 1931 the omission of the fourth spray of lime-sulfur resulted in a greater amount of infection than the omission of any other spray. In 1932 leaf spot was more severe and again the most important spray was the fourth. A large amount of infection occurred after August 10th and a fifth spray would have been needed to control the disease effectually. The severe infection of the Early Richmond was probably due to the early infection of many root sprouts that served later as a source of inoculum. Such sprouts should have been removed or sprayed.

Wilt and Die-back of the White Elm.—The results of this study are being printed as Research Bulletin 70. The organism is apparently identical with that described by Curtis May of Ohio and is a species of Cephalosporium. The only control found is that of early removal of infected portions of the tree before the disease becomes well established.

Diseases of Garden Beans in Nebraska.—Many bean fields were examined in the Scottsbluff irrigated district for diseases. Bacterial halo-blight was found to be the most serious disease of field beans, and this disease, with bacterial wilt, is so common and severe that it will limit the varieties that can be profitably grown in that area. Variety tests are being conducted by the Agronomy Department and efforts are being

made to produce disease-free seed of the Great Northern variety.

POULTRY

The Feeding Value of Various Dried-meat Products.—Since great variation has been reported in the value of various meat products as poultry feed a series of experiments was planned in which 20 parts of dried-meat product adjusted with starch to the same protein level were added to 80 parts of basal ration. Four kinds of meat meal, namely meat meal cracklings, tankage, meat and bone meal, and meat meal cracklings with a protein level slightly higher than that of the first-named kind, were compared in lots of one hundred Leghorn chicks each. The data indicate no striking differences in the growth-promoting value of the various products when fed at the same protein level.

The Antirachitic Value of Cod-liver Stearine for Growing Chicks.—The rickets-preventing value of stearine and the crude cod-liver oil from which the stearine was produced were compared in two series of experiments. It is apparent from the results that about 40 per cent more stearine than crude cod-liver oil is required to supply a given number of anti-rachitic units.

Nutritive Value of Wheat and Wheat-milling Products for Growing Chicks.—Wheat and its milling products are relatively rich in the vitamin B complex factor. The concentration of these in different parts of the wheat kernel was studied by adding ground wheat, bran, and shorts at parallel protein levels to a basal ration made deficient in the B_1 part of the B complex. A marked difference in the rate and quality of feathering in the three lots of chicks was noted. Wheat bran apparently carries a factor which stimulates smooth feather development. A second trial gave similar results.

Modifying the Calcium:Phosphorus Ratio of a Specific Ration for Poults.—It was observed that poults were able to tolerate a considerable variation in the Ca:P ratio when liberal amounts of vitamin D and ultra-violet energy were provided. In the first series of experiments calcium carbonate additions were made to effect the Ca:P ratio variations. When vitamin D and ultra-violet energy were withheld the ration with higher calcium level (four per cent calcium carbonate) and wider ratio prolonged the life of the poults considerably.

Effect of Humidity on the Hatchability of Turkey Eggs.—Two small cabinet incubators with a fan system have been obtained for this work, which has just been started. In the

first phase, relative humidities of 40 and 70 per cent have been maintained throughout the hatch. The weight loss was modified but the hatchability of the eggs was not affected.

The Comparative Efficiency of Various Proteins in Poultry Feeding.—In last year's report a plan for studying the net retention of nitrogen, phosphorus, and calcium was described. Since then four lots of 69 chicks each have been handled in the manner outlined, and a fifth lot of 64 is being studied. The Ca:P ratio was varied and the effects of variations on net and absolute retentions were studied. The conclusions reached were as follows:

1. The net retention and absolute retention of nitrogen and phosphorus are not affected by widening the Ca:P ratio.
2. The net retention of calcium decreases as the percentage of calcium in the ration increases, other factors being equivalent.
3. The absolute retention of calcium in the bird is unaffected by an increase in calcium in the ration.

The Department of Poultry Husbandry co-operates with the Department of Chemistry on this project and on the others that involve the nutrient requirements of growing chicks.

RURAL ECONOMICS

Nebraska Farm Land Prices.—This project consists of three parts. One is a history of farm land prices from 1860 to 1932. The consideration involved in nearly every transfer by warranty deed has been obtained for eleven Nebraska counties.

A second part is a study of the farm mortgage history of eleven southeastern Nebraska townships, chiefly in York county. The results of this study have been published as Research Bulletin 67.

A third part deals with the assessed and sales value of Nebraska farm land for the years 1921-32. Almost all of the tabulation on this phase has been completed.

Cost of Marketing Corn and Wheat in Nebraska by Different Methods.—Statistics on price, production, and related phases are being added regularly to those already collected. Analysis of this material, together with current market information, provides the basis for the material presented each month in the "Nebraska Economic Situation". It also provides a clearer insight into cyclical and seasonal price movements, their frequency of occurrence, and their causes.

Audit data for 79 farmers' elevators for 1931 were added to similar data already tabulated. The three main aspects of

this study are: the financial status of Nebraska farmers' elevators, 1920-31; the operating results for the same years; and the development of standards for the use of local elevators in analyzing their operating results.

Data on the market movement of the principal grains and classes of livestock were added to similar data already collected. Seasonal and regional differences in the marketing movement of these products and the factors accountable for these differences are being studied.

Cost of Producing Farm Crops.—Farmers in various parts of the state co-operate in this work. They keep accurate records of hours of labor and other costs of various farm operations and these records are tabulated at the college. Records are being kept on wheat, corn, tractors, horses, and potatoes. The number of records ranged from 249 on corn in 1932 to 10 on tractors in the same year. In 1933 the numbers of records were increased.

Farm Organization and Farm Costs.—This project utilizes the farm account book for obtaining information upon the relative profit obtained under different systems of organizing the farm business in the various areas of the state. Many of the co-operators who keep a farm record book also keep cost-of-production records on one or two crops. About 1,000 books were placed with farmers for 1933. A manuscript is in preparation on "Effects of Inflation and Deflation upon Nebraska Agriculture, 1914-1932", in which some of the data obtained in this project will be used.

Transporting Livestock to Market.—This project was closed in the autumn of 1932 with the publication of Bulletin 275, "Truck and Rail Transportation of Nebraska Livestock to the Omaha Market".

Economic Studies in Prices, Volume of Production, and Purchasing Power of Farm Products.—Data on the prices paid farmers for corn, wheat, oats, hogs, butterfat, eggs, and potatoes at different places in the state from January, 1895, to December, 1932, have been assembled and published in Bulletin 284.

Sources and Expenditures of Public Revenue, with Special Reference to Nebraska.—This emergency project was created as a result of numerous requests for information on tax matters. Such requests became exceptionally numerous in the spring of 1932. A series of twelve circulars on taxation was published by the Experiment Station, part of which were written by members of the Department of Rural Economics

and part by people outside of the Department. Prof. G. O. Virtue acted as editor of the series. A charge of 50 cents is made for the twelve circulars.

STATE SERUM PLANT

Notwithstanding the declining hog market, the Federal pig-buying activity, and the absence of large outbreaks of cholera, the sales of serum were a little larger than in 1932. All orders for serum and virus were filled promptly, and a liberal supply of serum was kept in storage for emergencies. The policy of buying serum subject to retest and of manufacturing virus was continued. Some virus had to be bought to meet temporary emergencies.

Clear concentrated serum sold for 50 cents per hundred cc. from January 1st to February 1st, when it was reduced to 40 cents. It sold at this price until April 1st, when it was reduced to 35 cents. It continued to sell at this price until August 14th, when the serum code established the price at 55 cents per hundred cc., and was sold at this price for the rest of the year.

Virus sold at 1 cent per cc. until August 14th, when the serum code set the price at 1½ cents, and it sold at that price the rest of the year.

A report of the sales by months and a financial statement for the calendar year 1933 are as follows:

Serum and virus sold by months:

	Cubic centimeters
Serum on hand January 1, 1933	6,975,000
Serum purchased and delivered during 1933	7,612,500
Total serum handled for year	14,587,500

Serum and virus sold by months:

	Serum cc.	*Virus* cc.
January	152,950	11,825
February	61,150	5,090
March	82,125	7,260
April	198,300	15,780
May	878,250	65,145
June	1,686,270	127,770
July	1,273,500	86,295
August	1,739,225	108,025
September	304,150	24,410
October	233,000	18,925
November	257,875	18,930
December	168,125	11,905
Total sold	7,034,920	501,360
Used by plant	22,200	5,250
Total	7.057,120	506,610

Serum on hand Jan. 1, 1934		7,530,380 cc.
Total gross sales	$30,420.66	
Money collected and receipted for	33,151.40	
Cash balance on hand Jan. 1, 1934, according to report of bursar		$77,236.38
Serum stock value		26,356.15
Accounts due and miscellaneous stock		534.75
Total assets		$104,127.28
Pigs used in retesting serum and making virus	522	
Number of orders for year	2,804	

NORTH PLATTE SUBSTATION

The experimental work at the North Platte Substation has been carried on as usual, with perhaps more stress on livestock. Severe storms have caused losses of $5,000 to $6,000 in property during the last two years.

The 1933 crop season was approximately normal in total precipitation although the rainfall was distributed erratically. The carry-over of soil moisture was slight and the winter precipitation low, and the soil was very dry in the early spring. During April and May, however, 8.58 inches of rain fell. In June and July 1.85 inches was recorded and in August and September the rainfall was slightly above normal. Late in November a slow rain of 1.15 inches left the soil in better condition for winter grains than for several years.

Dry-land Crops and Tillage Practices.—The shortage of moisture during the winter and early spring resulted in a heavy loss of winter grains. The only survival of winter wheat was on fallow and on early fall plowing after small grain. Of these two the yield was but little better on fallow. Spring grains fared relatively better than winter wheat; the yields were only slightly below normal. Yields of corn averaged about 24 bushels per acre, which is about 20 per cent above normal. It was a good year for grain and forage sorghums: Kalo, a promising new grain sorghum, yielded 33 bushels per acre on cropped land and 59 on fallow; Club Kafir, another new and later-maturing variety, yielded 29 bushels on cropped land and 64 on fallow. Potatoes were injured by the dry weather and yielded the lowest in twelve years; the highest yield was 55 bushels of No. 1 potatoes per acre after fallow, while the average on cropped land was 24 bushels. The results of dry-land crop production for the period 1907-31 have been published as Bulletin 279.

Pump Irrigation.—During the season of 1933 the irrigation pumping plant was operated during five months on 39 days for a total of 322.5 hours. During this time 5,750 kw.-

hrs. of electricity were used and 822.2 acre inches of water pumped, at a cost of $151.54 for power and $99.45 for labor. Water was applied to 42.7 acres of corn, 1 acre of potatoes, 5.5 acres of alfalfa, 6.0 acres of sudan pasture, and 15 acres of ground to be seeded to new alfalfa. Yields of corn ran from about 30 to 85 bushels per acre and averaged over 59. Potatoes yielded about 400 bushels per acre.

No attempt has been made to estimate the value of the increased production due to irrigation, but apparently as in years past it may be made to pay even under low prices and the high lift at this plant. Probably the outstanding feature demonstrated in the past several seasons is the fact that by generous use of water land may be got ready to support a stand of alfalfa when under natural conditions it would take a number of years to accomplish the same result.

Corn, Wheat, and Rye for Fattening Calves.—The third year's work on this project has been completed. The data obtained confirm the results of the previous years.

Creep Feeding Calves.—This work was continued; the results agree with data previously obtained.

Feeding Cattle on Native Grass.—Steer calves which had been wintered on alfalfa hay and about 6 pounds of corn per head daily were fed in four ways: one lot was finished in dry lot on ground corn and alfalfa hay; a second lot was full-fed ground corn on native grass for three months and finished in dry lot; a third lot was fed 8 pounds of ground corn on native grass for three months and finished in dry lot; the fourth lot was grazed on native grass for three months without grain and then finished in dry lot. Any of the methods is practical under western Nebraska conditions. The method to follow depends largely on the quality of cattle, the relative prices of corn, alfalfa, and pasture, and the time at which one wishes to market the cattle.

Hogs.—In a trial in which 57-pound pigs were fed until they weighed approximately 220 pounds, there was no appreciable difference in the feeding value of white and yellow corn when supplemented with tankage and alfalfa hay. Replacing one-half of the corn with ground rye did not decrease the average daily gain but did increase the grain requirement for 100 pounds of gain by 14 per cent. When all the corn was replaced with ground rye the average daily gain dropped from 1.45 to 1.21 pounds and the grain requirement per unit of gain increased 14 per cent. With whole instead of ground rye the daily gain was 1.13. The whole rye was 95 per cent as efficient as ground rye in producing gains.

Sheep.—The flock of grade ewes is kept on a farm flock basis. No experimental lamb feeding was done this year.

Poultry.—A flock-testing project was begun this year in cooperation with the Department of Poultry Husbandry and the Extension Service. Entries of 100 eggs are incubated in the same incubator; the chicks are brooded together in large units; and records are kept of egg grades, fertility of the eggs, hatchability, death loss, and growth. In the fall 12 pullets from each entry will be selected and trapnested during their pullet year. Differences are already apparent.

Horses.—Progress is being made in the development of the Percheron herd. Interest is reflected in the ready sale of surplus breeding animals.

The Holstein Herd.—The quality of the herd has been much improved by the disposal of the older and less desirable cows. There has been only a fair demand for bulls. Since July 1, 1932, the Advanced Registry Office has reported 17 365-day semiofficial records. All age classes except Senior 1 and Senior 4 are represented. The average of the 17 records is 722.9 pounds of fat, with three records above 800, one reaching 893.

The daughters of the former herd sire, N P Hengerveld Topsy Count, and the present herd sire, Sir Triune Pansy 24th, are finding permanent places in the herd. A daughter of the former bull raised the herd record in the Junior-2 class by producing 18,978 pounds of milk, or 696.6 pounds of fat. A daughter of the latter produced 19,937 pounds of milk, or 717.1 pounds of fat. These cows show quality and size as well as productive power.

Horticulture.—The past season has given further evidence that some species of trees will not live during periods of long-continued drouth at the North Platte Substation without special care and attention. Jack Pine in most of the plantings has died, presumably because of insufficient moisture. Western Yellow, Scotch, and Austrian pines have lived under similar conditions. It would seem that the Jack Pine should be confined to the sandy soils. Many of the Black Hills spruce which had been growing for twenty years and had attained a height of 20 to 25 feet died, presumably also for lack of moisture. Russian Olive trees have been dying back for the past several years. The loss among the irrigated trees is at about the same rate as among the trees on dry land.

Hackberry, American Elm, and Honey Locust are still the best deciduous trees for lawn and street planting, with Colorado Blue Spruce, Austrian pine, and Black Hills spruce as

the most satisfactory conifers. Many of the more ornamental evergreens are satisfactory for lawn planting where given the proper care.

The Chinese Elm is still on trial. Its special value lies in its rapid growth, uniform shape, and dense foliage held into the late fall. Its chief fault, a serious one, is its susceptibility to infection wherever the bark is opened. This is made apparent by lack of proper healing where a limb has been removed, and by the bark becoming loose around the unhealed scar. The good qualities of this tree may outweigh its defects. It grows so quickly that the removal of an older one is not a serious matter. It would seem that the Chinese Elm has a distinct place in the windbreak where it will not be pruned.

The growing of cedars and pines from seed and planting in the canyon pastures has been continued. The weather conditions have been so unfavorable during the past three years that the percentage of survival of the trees set each spring has been small. The trees once established are doing nicely. The project is worthy of continued effort.

Progress has been made in extending the plantings of perennial flowering plants and shrubs.

SCOTTSBLUFF SUBSTATION

The work at this station is carried on in co-operation with the Office of Western Irrigation Agriculture of the U. S. Department of Agriculture. The weather conditions in the spring of 1933 were good. June and July, however, were dry and hot. August and September were normal in temperature and precipitation. The growing season was average in rainfall but the rain was unevenly distributed. Yields of potatoes were high, while the yields of beets were below the average.

Crop Rotations.—The irrigated rotation experiments are now carried on in three fields: Field K, in which the first series were begun in 1912 with others added in 1920; Field E, in which experiments were begun in 1926 and other cropping systems added in 1931; and Field C, in which a 12-year, maximum-yield rotation was begun in 1932. In these three fields are 11 continuous cropping experiments, 16 2-year, 4 3-year, 10 4-year, 5 6-year, 1 7-year, and 1 12-year rotations. The results of the past year correspond with those of previous years. They continue to show the benefits of manure, and of alfalfa and sweet clover in the rotation. The potato crop, because it is planted late, makes a better use of sweet clover as a green manure crop than other crops do, especially sugar beets.

Fertilizing Tests with Sugar Beets.—The results of fertilizer tests up to the present can best be shown by the following table:

Quantities of manure applied and yields of sugar beets obtained from a 5-year fertilizing experiment in Field E, Series I and II, Scottsbluff Substation, 1926 to 1933

Plat No.	Tons of manure per acre						Yields of sugar beets in tons per acre				
	1926	1927	1928	1929	1930	Total	5-yr. av. 1926-30	1931	1932	1933	3-yr. av.
I- 7	6	6	6	6	6	30	18.0	12.1	16.3	12.7	13.7
8	12	6	6	6	0	30	18.2	10.8	15.6	11.5	12.6
9	18	6	6	0	0	30	18.1	10.0	11.8	11.5	11.1
10	24	6	0	0	0	30	18.2	10.8	13.8	12.1	12.2
11	30	0	0	0	0	30	17.6	10.5	16.8	13.2	13.5
Average							18.0	10.8	14.7	12.2	12.6
II- 7	6	6	6	6	6	30	17.0	11.3	14.4	11.3	12.3
8	12	12	12	12	12	60	19.1	13.1	17.8	13.6	14.8
9	18	18	18	18	18	90	20.5	12.9	21.7	14.0	16.2
10	24	24	24	24	24	120	20.9	13.8	18.9	16.5	16.4
11	30	30	30	30	30	150	21.8	16.5	21.2	16.1	17.9
Average							19.9	13.5	18.8	14.3	15.5

Irrigation Tests with Sugar Beets.—This experiment was begun last year and its purpose is to determine the effect of watering sugar beets at various intervals during the latter part of the season. The effect on sugar content will also be studied. The work has not been advanced far enough for conclusive results.

Potatoes.—A series of tests was begun with an early-maturing strain of Triumphs to compare this strain with Cobbler, which is usually selected as an early potato in this valley. The results thus far indicate that this strain of Triumph is fully the equal of Cobbler as an early market potato.

Lamb Feeding.—The last year of a three-year lamb-feeding test was completed. Wheat has been used in connection with other feeds, and uniform gains were obtained from the lots in which it was fed.

Dairying.—The division of the herd into two groups, one of which gets a grain supplement while the other is fed roughage alone, has been continued. The average profit above feed cost has been practically the same in both lots.

Poultry.—The work with poultry is demonstrational rather than experimental. Ordinary farm conditions are approximated and by attention to care and feeding it is being shown that a small flock can be made to yield a profit.

Experimentation with Vegetables.—In 1931 variety testing was begun with vegetables for the purpose of determining the varieties best suited for home gardens, commercial production, and canning. The general aim has been to investigate the possibility of promoting the canning industry in the North Platte valley. Some small fruits were included in 1932. Obviously unadapted varieties are discarded each year and new ones are added. Spinach, lettuce, egg plant, peppers, string beans, cabbage, cauliflower, peas, sweet corn, onions, tomatoes, blackberries, raspberries, and strawberries were grown in 1933. The number of varieties of each ranged from 4 to 24. The data on yields are available for those interested.

VALENTINE SUBSTATION

Agronomy.—The season of 1932 was quite favorable for crop production on the hard land. Corn and hay yields were reduced somewhat by dry weather from the middle of June on. There was an abundance of moisture during the early spring, which probably accounts for the high yield of oats. Winter wheat was a failure because of a dry fall and winter.

Work with small grain varieties has been discontinued near the substation because the soil is not adapted to these crops. Variety work is being continued on the hard land north of the substation. On that soil eight varieties of oats averaged 52 bushels; five of barley, 16 bushels; five of spring wheat, 19 bushels; and spring rye, 14.1 bushels. Milo and Kafir yielded 1,450 and 1,475 pounds of heads per acre.

On the substation soil amber cane continues to produce more tonnage than either sudan or millet. All forage crops yielded less than one ton per acre this season. Nine varieties of grain sorghums were tested but none gave a profitable return in either grain or forage. However, some of the varieties appear worthy of further trial.

Wintering Range Calves.—Over a five-year period calves wintered on prairie hay without a supplement made an average winter gain of 25 pounds. The average daily hay consumption was 10.5 pounds. During the same period various amounts of cottonseed cake have been used as a supplement with profitable results. Since considerable corn, oats, and rye are produced in or near the ranch country, the current project has compared the relative values of these grains. The following are the lot supplements used:

Supplements daily per head	Winter gain	Total winter and summer gains
	Pounds	*Pounds*
Cottonseed cake, ¾ lb.	185	330
Ground rye, 2 lbs.	154	343
Cottonseed cake, ½ lb., and ground rye, 1 lb	191	368
Corn, 2 lbs.	119	317
Cottonseed cake, ½ lb., and corn, 1 lb.	165	311
Cottonseed cake, ½ lb., and oats, 1 lb.	201	349

The quality of corn varies considerably from year to year and has a marked effect upon its feeding value. Generally speaking, the choice between the several supplements used will depend largely upon their accessibility and cost.

Dairy Cattle.—The small herd of purebred Holsteins is managed as a demonstration herd. The data kept include breeding, feeding, and production. The herd has a five-year average on two-time milking of 411 pounds of butterfat. There has been a good demand for surplus females, but only a fair demand for bulls.

Poultry.—While there has normally been a decrease in the fertility and hatchability of turkey eggs as the laying season has advanced, the decrease this year was unusually great. Eggs placed in the incubator April 5th showed 94 per cent fertility and 73 per cent hatchability. By the last of May these percentages had dropped to 63 and 13.

Meadow Investigation.—The water table in the subirrigated meadows has lowered sufficiently in many places to make seeding of clover unprofitable. The stand on established clover meadows has been reduced and yields cut close to 25 per cent.

Trees.—The shelter belt plantings of 20 years ago suffered considerable loss the past year. American Elm has 100 per cent survival. The heaviest loss has been with Boxelder and Honey Locust. A belt of Chinese Elm set out three years ago have suffered no loss since the first month.

BOX BUTTE EXPERIMENT FARM

The Box Butte Experiment Farm is under the general supervision of a committee and the experimental work is directed by members of the Departments of Horticulture, Plant Pathology, and Agronomy. Most of the work is with potatoes and potato diseases; there are in addition rotation and other agronomic experiments. Changes in method of management and in personnel have been made recently in an effort to reduce expense and improve the efficiency of operation. The new plans, which have been in effect since October 1, 1933, are working satisfactorily.

CHANGES IN STAFF

John F. Pospisil, Superintendent of the Box Butte Experiment Farm, resigned, effective September 30, 1933. George Schmid was appointed manager, to have charge of all general farm operations and finances, and Bill Allington was appointed to take charge of all experimental work with potatoes.

PUBLICATIONS OF THE LAST FISCAL YEAR

The publications of the station for the fiscal year covered by this report are as follows:

ANNUAL REPORT

Forty-sixth Annual Report, presented to the Governor February 1, 1933. 1,500 copies.

BULLETINS

No. 273, Seed Preparation and Planting Methods for Spring Small Grains. T. A. Kiesselbach and W. E. Lyness. July, 1932. 5,000 copies.

No. 274, The Contract Feeding of Livestock. R. R. Thalman. July, 1932. 20,000 copies.

No. 275, Truck and Rail Transportation of Nebraska Livestock. Basil S. Wendt and Harold Hedges. October, 1932. 3,000 copies.

No. 276, Feeding Tests and Carcass Studies with Early Spring Lambs and Aged Western Ewes. A. D. Weber and Wm. J. Loeffel. December, 1932. 5,000 copies.

No. 277, Nebraska Tractor Tests, 1920-1932. Board of Tractor Test Engineers. January, 1933. 3,000 copies.

No. 278, Soil Management Experiments with Vegetables. H. O. Werner. January, 1933. 4,000 copies.

No. 279, Dry Land Crop Production at the North Platte Experiment Substation. L. L. Zook. February, 1933. 3,000 copies.

No. 280, Turkey Production. F. E. Mussehl. April, 1933. 8,000 copies.

No. 281, Fattening Yearling Heifers on Alfalfa Pastures. Marvel L. Baker. May, 1933. 5,000 copies.

RESEARCH BULLETINS

No. 61, Tuber Development of Triumph Potatoes as Influenced by Time of Planting on Dry Land in Northwestern Nebraska. H. O. Werner. May, 1932. 3,000 copies.

No. 62, The Vitamin A and the Vitamin E Content of Field-Cured and Artificially Cured Alfalfa Hay. I. L. Hathaway, H. P. Davis, and R. R. Graves. October, 1932. 3,000 copies.

No. 63. The Nature of Resistance in Alfalfa to Wilt (*Aplanobacter insidiosum* L. Mc.). George L. Peltier and F. R. Schroeder. October, 1932. 4,000 copies.

No. 64, Factors Affecting the Performance of Kerosene Cook Stoves. Edna B. Snyder. November, 1932. 2,000 copies.

No. 65, The Identification of the More Important Prairie Hay Grasses of Nebraska by Their Vegetative Characters. F. D. Keim, G. W. Beadle and A. L. Frolik. December, 1932. 3,000 copies.

No. 66, The Relative Susceptibility of Alfalfas to Wilt. George L. Peltier. April, 1933. 4,000 copies.

CIRCULARS

No. 41, Selection and Management of Kerosene Cook Stoves. Edna B. Snyder. July, 1930. 5,000 copies. (Not listed in 45th Annual Report.)

No. 42, The Use of a Small Electric Motor in Silo Filling. E. E. Brackett and E. B. Lewis. August, 1930. 5,000 copies. (Not listed in 45th Annual Report.)

No. 43, The University Fruit Farm. C. C. Wiggans. September, 1931. 3,500 copies. (Listed in 46th Annual Report.)

No. 44, Why Some Hens Lay More Eggs Than Others. H. E. Alder. November, 1932. 4,000 copies.

No. 45, Fitting the Mechanical Refrigerator into the Home. E. B. Lewis and M. P. Brunig. May, 1933. 5,000 copies.

No. 46, White Scours of Calves. L. Van Es. May, 1933. 7,000 copies.

TECHNICAL PAPERS

Anderson, Arthur. The Spring Small Grains in Nebraska. 24th Annual Report Nebr. Crop Growers' Assoc. 71-76. 1933.

Blish, M. J. Report on Diastatic Value of Flour. Jour. Assoc. Offic. Agr. Chemists 15: 572-82. 1932.

Blish, M. J., Sandstedt, R. M., and Astleford, G. R. Sugars, Diastatic Activity, and "Gassing Power" in Flour. Cereal Chem. 9: 378-93. 1932.

Blish, M. J., and Hughes, R. C. Some Effects of Varying Sugar Concentrations in Bread Dough on Fermentation By-products and Fermentation Tolerance. Cereal Chem. 9: 331-56. 1932.

Blish, M. J., and Sandstedt, R. M. An Improved Method for the Estimation of Flour Diastatic Value. Cereal Chem. 10: 189-202. 1933.

Kiesselbach, T. A. Producing Hybrid Seed Corn on the Farm. 24th Annual Report Nebr. Crop Growers' Assoc. 87-100. 1933.

Marvin, H. H., and Baragar, A. E. Zeeman Effect in the Arc Spectrum of Nickel. Physical Rev. 43: 973-9. 1933.

Mussehl, F. E., and Ackerson, C. W. Effect of Modifying the Ca:P Ratio on a Specific Ration for Growing Turkeys. Atti del V Congresso Mondiale di Pollicoltura. 2a Sezione, N. 63. 1933.

Mussehl, F. E., and Ackerson, C. W. Effect of Modifying the Ca:P Ratio of a Specific Ration for Growing Chicks. Poultry Sci. 11: 293-6. 1932.

Mussehl, F. E., and Ackerson, C. W. The Antirachitic Value of Sardine Oil for Growing Chicks. Poultry Sci. 12: 31-3. 1933.

Mussehl, F. E., Blish, M. J., and Ackerson, C. W. Effect of Dietary and Environmental Factors on the pH of the Intestinal Tract. Poultry Sci. 12: 120-3. 1933.

Peltier, G. L. Relation of Weather to the Prevalence of Wheat Stem Rust in Kansas and Nebraska. Jour. Agr. Res. 46: 59-74. 1933.

Peltier, G. L. Physiologic Forms of Wheat Stem Rust in Kansas and Nebraska. Phytopath. 23: 343-56. 1933.

Roberts, Raymond. Two New Species of Vespoidea (Hymenoptera), with Notes on a Previously Named Species. Jour. Kans. Ent. Soc. 6: 91-8. 1933.

Skidmore, L. V. The Transmission of Fowl Cholera to Turkeys by the Common House Fly. Cornell Vet. 22: 281-85. 1932.

Skidmore, L. V. Leucocytozoon Smithi Infection in Turkeys and its Transmission by Simulium occidentale. Zentralbl.. f. Bakter. 1 Abt. Orig. 125: 329-30. 1932.

Skidmore, L. V., and Petersen, N. F. Observations on the Toxicity of Golden Glow (*Rudbeckia laciniata*) to Swine and Other Animals. J. A. V. M. A. 81:655-62. 1932.

Skidmore, L. V. Comparative Study of Acariasis of the White Rat. Jour. of Parasitology 19: 172. 1932.

Skidmore, L. V. Water Hemlock (*Cicuta maculata*) Poisoning in Swine. Vet. Jour. 89:76-80. 1933.

Skidmore, L. V., and McGrath, C. B. Canine Coccidiosis Due to *Eimeria canis*. J. A. V. M. A. 82:627-29. 1933.

Snyder, E. B., and Winegar, Gladys. A Study of the Comparative Wear on Three Cotton Fabrics from Fifty Washings by a Home and a Commercial Laundry. Jour. Home Economics 25: 488-90. 1933.

Suneson, C. A. Our Best Varieties of Winter Wheat and Prospects for Better Ones. 24th Annual Report Nebr. Crop Growers' Assoc. 67-71. 1933.

Swenk, M. H. A History of Nebraska Ornithology—Part I, The Ancient Period, Fossil Birds. Nebr. Bird Rev. 1: 50-3. 1933.

Swenk, M. H. The Ancient Murrelet Wanders to Nebraska. Nebr. Bird Rev. 1: 14-15. 1933.

Swenk, M. H. A Second Record of the European Starling in Nebraska. Nebr. Bird Rev. 1: 15. 1933.

Swenk, M. H. The Exact Type Localities of the Birds Discovered in Nebraska by Thomas Say on the Long Expedition. Nebr. Bird Rev. 1: 33-5. 1933.

Swenk, M. H. The Correct Status of the Oldsquaw as a Nebraska Bird. Nebr. Bird Rev. 1: 11-12. 1933.

Swenk, M. H. The Swallow-tailed Kite in Pottawattamie County, Iowa. Wilson Bul. 44: 182. 1932.

Tysdal, H. M. Present Day Recommendations on Alfalfa Production. 24th Annual Report Nebr. Crop Growers' Assoc. 105-13. 1933.

Tysdal, H. M. The Influence of Light, Temperature, and Moisture on the Hardening Process in Alfalfas. Jour. Agr. Res. 46: 483-515. 1933.

Van Es, L. The Three Types of Tubercle Baccilli in Live Stock Sanitary Control Work. J. A. V. M. A. 82:407-19. 1933.

Wiggans, C. C. Apple Packages and Storage. Ann. Rep. Nebr. Hort. Soc. 142-5. 1932.

Yocum, W. W. The 1932 Spray Tests at Shubert. Ann. Rep. Nebr. Hort. Soc. 131-5. 1932.

THE AGRICULTURAL EXPERIMENT STATION OF NEBRASKA

FINANCIAL STATEMENT OF MONEY RECEIVED FROM THE UNITED STATES GOVERNMENT

HATCH FUND

Receipts

Received by the State Treasurer, who is also the treasurer of the University of Nebraska, installment for the fiscal year ended June 30, 1933, under act of Congress approved March 2, 1887. Total.....$15,000.00

Expenditures

For salaries.....$15,000.00

Total.....$15,000.00

ADAMS FUND

Receipts

Received by the State Treasurer, who is also the treasurer of the University of Nebraska, installment for the fiscal year ended June 30, 1933, under act of Congress, approved March 16, 1906. Total.....$15,000.00

Expenditures

For salaries.....$15,000.00

Total.....$15,000.00

Dated at Lincoln, Nebraska,
January 5, 1934.

L. E. GUNDERSON,
Finance Secretary.

PURNELL FUND

Receipts

Received by the State Treasurer, who is also the treasurer of the University of Nebraska, installment for the fiscal year ended June 30, 1933, under act of Congress approved February 24, 1925. Total $60,000.00

Expenditures

SALARIES		
Regular	$38,310.57	
Temporary	3,781.40	
Total		$42,091.97
SUPPLIES		
Office Supplies	$ 318.06	
Laboratory Supplies	3,780.16	
Education and Recreational	20.99	
Barn Supplies	3.05	
Feeding Stuffs	2,914.23	
Agricultural Supplies	524.47	
Total		$ 7,560.96
EXPENSE		
Office Expense and Postage	$ 91.42	
Freight, Express and Drayage	78.77	
Water, Heat, Light and Power	15.79	
Public Printing and Advertising	828.05	
Traveling Expense	2,269.09	
Rentals	217.41	
Special and Temporary Services	5,050.26	
Miscellaneous	18.95	
Total		$ 8,569.74
REPAIRS		
Buildings	$ 48.73	
Equipment	286.67	
Total		$ 335.40
EQUIPMENT		
Furniture and Fixtures	$ 357.80	
Apparatus (Labor and Equipment)	794.02	
Machinery	125.30	
Books, Magazines, etc	20.10	
Total		$ 1,297.22
LANDS AND BUILDINGS		
Land Improvements	$ 144.71	
Total		$ 144.71
GRAND TOTAL		$60,000.00

Dated at Lincoln, Nebraska,
January 5, 1934.

L. E. GUNDERSON,
Finance Secretary.

FINANCIAL STATEMENT

Statement of expenditures for the Agricultural Experiment Station of the University of Nebraska for the year ended June 30, 1933 (exclusive of Federal Funds), including expenditures for central station at Lincoln, and substations at North Platte, Scottsbluff, Valentine, Union, and Alliance.

SALARIES AND WAGES		
Regular	$79,643.25	
Temporary	2,985.13	
Total		$82,628.38
SUPPLIES		
Office Supplies	$ 880.08	
Laboratory Supplies	5,656.98	
Fuel (Coal)	1,197.13	
Food Stuffs	2,146.52	
Educational and Recreational	135.43	
Janitor and Barn Supplies	689.91	
Agricultural Supplies	4,591.84	
Feeding Stuffs	17,354.78	
Total		$32,652.67
EXPENSE		
Office Expense and Postage	$ 1,109.91	
Freight, Express and Drayage	881.07	
Water, Heat, Light, Power and Fuel	4,579.45	
Public Printing, Advertising and Photography	4,124.80	
Traveling Expense	1,955.88	
Rentals	226.00	
Special and Temporary Services	22,086.12	
Miscellaneous	1,016.20	
Total		$35,979.43
REPAIRS		
Building	$ 2,853.81	
Lands	232.22	
Equipment	4,746.34	
Total		$ 7,832.37
EQUIPMENT		
Furniture and Equipment	$ 1,332.66	
Apparatus (Labor and Equipment)	1,765.34	
Livestock	12,224.96	
Machinery	1,511.26	
Books	214.91	
Total		$17,049.13
LANDS AND BUILDINGS		
Land	$ 494.25	
Land Improvement	799.80	
Original Construction	571.37	
Total		$ 1,865.42
GRAND TOTAL		$178,007.40

Dated at Lincoln, Nebraska,
January 5, 1934.

L. E. GUNDERSON,
Finance Secretary.

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